

REMARKS

Election/Restriction

The Examiner has withdrawn claims 27-29 as directed to an invention distinct from the invention originally claimed, and has withdrawn them from consideration based on prosecution on the merits of the original invention. As the amendments in the response mailed January 25, 1999 were not entered, Applicant hereby again acknowledges withdrawal of claims 27-29, and cancels claims 27-29 without traverse, but reserves the right to resubmit them at a later time in a divisional application.

Objection to Specification Under 35 U.S.C. § 132

The amendment filed December 1, 1997 was objected to under 35 U.S.C. § 132 as introducing new matter into the disclosure. The Advisory Action dated February 17, 1999, but received by Applicant on March 25, 1999, states that Applicant's response mailed January 25, 1999 would overcome this rejection. Accordingly, Applicant requests entry of the proposed amendment to the specification, along with reconsideration and withdrawal of the objection under 35 U.S.C. § 132.

Rejection Under 35 U.S.C. § 112

35 U.S.C. § 112, second paragraph

In the Office Action mailed October 26, 1998, claims 1, 23, 25 and 26 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to point out and claim the subject matter of the invention. Claims 23, 25 and 26 are canceled hereby without prejudice in favor of entry of new claims 31-54.

As to pending claim 1, the rejection asserts that "it is not clear what the meets and bounds of 'a chemically reactive distance of the substrate' would be." Applicant herein amends claim 1 to remove the language objected to in the rejection.

The rejection asserts, "The confusion arises because applicant's description of the gas volume as being located where heterogenous [sic] reactions (surface reactions) take place and the

fact that the gas volume is 'within a chemically reactive distance of the substrate' would lead one of ordinary skill in the art to believe the that [sic] particular volume of gases were reacting with the surface of the substrate or at least extremely near the surface of the substrate in order to be able to react with the substrate." Office Action, part 3, para. 3. While this characterization no longer applies to claim 1 as amended, Applicant will address the comment as it may find application with reference to newly entered claims.

Applicant respectfully submits that the rejection mischaracterizes the nature of the reaction volume as including only those reactant gases actively involved in heterogeneous reactions. While reactant gases in the reaction volume take part in heterogeneous chemical reactions, there is no limitation that the reaction volume include only those gases immediately taking part in heterogeneous chemical reactions at the substrate surface.

The rejection and the Advisory Action comments utilize an extrinsic reference to create a definition of Applicant's reaction volume that is restricted to the boundary layer where heterogeneous reactions take place, i.e., "angstroms, or nanometers thick." *See, e.g.*, Advisory Action, p. 2, comments. Applicant respectfully submits that it is clear Applicant's disclosure does not support such a restrictive definition. To adopt such a definition is inconsistent with Applicant's teaching that the substrate surface need not be illuminated.

The Advisory Action states, "Applicant's disclosure clearly teaches the gas volume to be that where reactions take place within a chemically reactive distance, which would be consistent with heterogeneous reactions and applicant's preferred embodiment directs the light at the substrate." Advisory Action, p.2. Applicant respectfully objects to this characterization. Applicant teaches that the reaction volume is a volume of gas located within a chemically reactive distance of the substrate. Applicant discloses that reactant gases in the reaction volume are referred to as taking part in heterogeneous chemical reactions. Applicant respectfully submits that it does not teach that the reaction volume contains only reactant gases taking part in heterogeneous chemical reactions. Again, Applicant respectfully submits that requiring the reaction volume of gas to include only that volume to be "that where reactions take place" is inconsistent with further teachings of Applicant. To adopt such a definition is inconsistent with

Applicant's teaching that the substrate surface need not be illuminated. Applicant further respectfully submits that it is improper to limit the invention to the example embodiment presented in the disclosure. "The content of applicant's specification is not used as evidence that the scope of the claims is inconsistent with the subject matter which applicants regard as their invention." MPEP § 2172.

The Advisory Action further states, "The suggestion that the light need not be directed at the substrate is mentioned in passing and there is no explanation to enable one skill in the art as to how this embodiment could be performed." Advisory Action, pp. 2-3. Applicant respectfully objects to this characterization. Applicant does not merely "mention[] in passing" that the light need not be directed at the substrate. After clearly teaching that it is not necessary to illuminate the substrate surface, Applicant continues, "This process is different from photon-assisted CVD, where it is the substrate reaction surface on which photons are directed to increase reaction rates." Specification, p. 5, ll. 24-26. Applicant respectfully submits that this clarification further supports that the reaction volume of gas includes gas volume other than that adsorbed on the substrate surface.

Applicant teaches, "We believe that the optical excitation of the reaction volume of the gases selectively increases only the concentration of ozone (O₃) or free oxygen atoms in the reaction gas mixture and not the concentration of TEOS present. It is believed that this increase in the atomic concentration of oxygen gives rise to a more efficient reaction with less carbon incorporation in the films which in turn leads to lower fixed charge in the films." Specification, p. 7, l. 29 through p. 8, l. 4. Applicant continues, "It is believed that the novel process of this invention makes it possible to have a functional increase in available atomic oxygen at the substrate surface, without increasing the O₃ concentration in the gas chamber reaction volume in atmospheric pressure CVD applications." *Id.*, p. 8, ll. 16-20. Accordingly, Applicant respectfully submits that the reaction volume of gas provides reactant gas to the substrate surface, but includes gas volume above the substrate surface. That is, because it is believed that an increase of the ozone or free oxygen atoms in the reaction volume of gas provides a functional increase in atomic oxygen at the substrate surface, the reaction volume of gas must provide

reactants to the substrate surface, and not consist solely of those constituents on the substrate surface.

The rejection asserts there is an apparent contradiction in how to illuminate the gases without illuminating the substrate. There is only an apparent contradiction if the definition of the reaction volume of gas proposed by the rejection and Advisory Action is accepted, which Applicant denies. Applicant respectfully submits that illuminating the substrate surface, as used in the specification, is the act of directing photons at the substrate surface from a light source. *See* specification, p. 7, ll. 23-26. Thus, Applicant respectfully submits that it was within the ordinary skill in the art at the time the application was filed to illuminate gases located within the reaction chamber without directing photons at the substrate surface.

“A patent need not teach, and preferably omits, what is well known in the art.” MPEP § 2164.01 (citing numerous decisions). “The specification need not contain an example if the invention is otherwise disclosed in such manner that one skilled in the art will be able to practice it without an undue amount of experimentation.” MPEP § 2164.02, citing, *In re Borkowski*, 422 F.2d 904, 908, 164 USPQ 642, 645 (CCPA 1970). Applicant thus respectfully submits that it was not necessary at the time the application was filed to expressly teach how to illuminate gases located above the substrate surface without directing photons at the substrate surface. Applicant further respectfully submits that it would not require an undue amount of experimentation to determine a location and orientation of a light source such that gases located above the substrate surface are illuminated without directing photons at the substrate surface.

In light of the amendments and arguments, Applicant respectfully requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, second paragraph, and allowance of claim 1.

35 U.S.C. § 112, first paragraph

In the Office Action mailed October 26, 1998, claims 1-24 and 26 were rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter not described in the specification in

such a way as to enable one skilled in the art to make/use the invention. Claims 3, 11-24 and 26 are canceled hereby without prejudice in favor of entry of new claims 31-54.

As to pending claims 1, 2 and 4-10, the rejection asserts, "For the reasons given above, one of ordinary skill in the art would not understand how to illuminate 'a gas volume located within a chemically reactive distance of the substrate' without illuminating the substrate." As noted in the discussion under 35 U.S.C. § 112, second paragraph, Applicant respectfully submits that it was within the ordinary skill in the art at the time the application was filed to illuminate gases located within the reaction chamber without directing photons at the substrate surface. Accordingly, and in light of the amendments, Applicant respectfully requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, first paragraph, and allowance of claims 1, 2 and 4-10.

Rejection Under 35 U.S.C. § 102(b)

In the Office Action mailed October 26, 1998, claims 25 and 30 were rejected under 35 U.S.C. § 102(b) as being anticipated by JP 2-050966 (Hisamune). Claims 25 and 30 are canceled hereby without prejudice in favor of entry of new claims 31-54. Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 102(b).

Rejection Under 35 U.S.C. § 103

In the Office Action mailed October 26, 1998, claims 1-24 and 26 were rejected under 35 U.S.C. § 102(b) as anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as obvious over JP 2-050966 (Hisamune). Claims 3, 11-24 and 26 are canceled hereby without prejudice in favor of entry of new claims 31-54.

As to pending claims 1, 2 and 4-10, the rejection states, "Hisamune clearly teaches applicant's process of illuminating ozone and a silicon source gas with a mercury arc lamp to deposit silicon dioxide onto a wafer surface." Applicant has carefully reviewed the Hisamune reference and is unable to locate a teaching of illuminating gases located within the reaction chamber without illuminating the substrate surface. Applicant is further unable to locate a

disclosure in Hisamune of doped SiO₂ films other than phosphorus-doped SiO₂ using TMP as a doping gas, nor any disclosure of forming SiO₂ films using more than one dopant source.

The rejection further states, "Hisamune teaches a deposition temperature of about 400°C and applicant claims about 480°C. Temperatures about 400°C, such as 440°C, would also be about 480°C. Therefore the Hisamune reference anticipates applicant's deposition temperature." Applicant respectfully objects to this extrapolation. The logic of the rejection could be extended in either direction to conclude that any temperature is the same as any other temperature, just by varying the number of steps in the extrapolation. Applicant respectfully submits that the cited reference, standing alone, does not teach nor suggest Applicant's deposition temperature of about 480°C.

The rejection continues, "Hisamune further teaches that the reason for irradiating the inside of the reaction furnace with UV radiation is to induce a photochemical reaction of the gaseous starting materials with ozone (translation, p. 5, lns. 20-21)." Applicant respectfully submits that this teaching supports Applicant's argument that Hisamune teaches illumination of the substrate surface, and not merely illumination within the reaction chamber.

Hisamune seeks to deposit an insulating film on the surface of a substrate. Translation, p.5, ll. 17-18. Applicant teaches that reactants in a CVD process are adsorbed on the substrate surface where they undergo a film-forming chemical reaction. Specification, p. 2, ll. 23-24. If the UV irradiation is to induce a photochemical reaction, and film-forming reactions take place among reactant gases adsorbed on the substrate surface, the substrate surface must be illuminated to induce a photochemical film-forming reaction at the substrate surface. This is consonant with the process of Hisamune having a light source located directly above the substrate surface. While Hisamune recites "irradiating the inside of the reaction furnace," Applicant respectfully submits that such a blanket statement neither teaches nor suggests illuminating gases located within the reaction chamber *without* illuminating the substrate surface, given the teaching that the irradiation is provided to induce a photochemical reaction. Please note that Applicant believes that the optical excitation of the reaction volume of the gases selectively increases the

concentration of ozone or free oxygen atoms in the reaction gas mixture, thus permitting illumination of other than the substrate surface. *See* specification, p. 7, l. 29 thru p. 8, l. 1.

The rejection further states that "it would have been obvious to choose the temperature of applicant's claimed process because Hisamune teaches temperatures near applicant's" Applicant respectfully submits that it has shown that Hisamune, standing alone, does not teach nor suggest a temperature near Applicant's deposition temperature.

In light of the foregoing, Applicant respectfully requests reconsideration and withdrawal of the rejections under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a), and allowance of claims 1, 2 and 4-10.

CONCLUSION

Claims 3 and 11-30 are canceled hereby. Claims 1, 2 and 4-10 are amended herein. Claims 31-54 are added hereby. Claims 1, 2, 4-10 and 31-54 are pending.

Applicant believes the claims are in condition for allowance and requests reconsideration of the application and allowance of the claims. The Examiner is invited to telephone the below-signed attorney at 612-371-2103 to discuss any questions which may remain with respect to the present application.

Respectfully submitted,

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Date of Deposit April 15, 1999

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